

ACCELERATING THE CIVIL WORKS PROCESS THROUGH SMART USE OF VALUE ENGINEERING

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INTRODUCTION

The prolonged time duration of the U.S. Army Corps of Engineers civil works process is currently a primary concern of Congress and Corps management. There is good reason for attention to this matter as it now normally takes up to ten years to actually construct a major project after the Corps is tasked to investigate and solve a flood control, navigation or other significant problem. It is not uncommon for projects to endure over six years of planning alone before it is authorized for detailed design and construction. Such delays have resulted in the public (the customer) becoming increasingly more disenchanted with the Corps.

For a major urban flood control project entitled, "Southeast Louisiana Flood Control", Congress has decided to forego four to five years of detailed feasibility analyses and has authorized the Corps to design and construct a project as defined by an 18 month reconnaissance study. Concurrent with the design of this project the New Orleans District is performing mandated value engineering on various project sub-components. This early use of value engineering, when a detailed feasibility study would normally be performed, has revealed that it may have potential as a suitable time saving substitute for selected projects.

THE CURRENT CIVIL WORKS PROCESS

There are four major components to the existing civil works process (1) : reconnaissance phase, feasibility phase, pre-construction engineering design (PED) and construction (see Figure 1). A brief description of each component is as follows:

Reconnaissance Phase - The objective of this initial planning step is to identify whether or not there may be a federal interest in participating in a project to solve a specific problem. It is generally accomplished with the gathering of available data and developing one or several plans that may generate greater benefits over costs. This study component must be completed within six to twelve months and at minimal cost which is 100 percent federally funded.

Feasibility Phase - The goal of the feasibility study is to evaluate all possible project alternatives and identify the best plan in the national interest (NED plan). This study is usually accompanied by either an Environmental Assessment or Environmental Impact Statement (EIS) which is mandated by law for most large projects. The feasibility study and EIS serves as the primary document for congressional authorization and funding. This study phase is accomplished by detailed data gathering, design engineering, economics, real estate and environmental analysis. The feasibility study and EIS solicits and incorporates public views and comments into the plan. This phase may take over five years for a major project and usually costs in the range of 5-10 percent of estimated project construction cost. Feasibility study EIS costs are equally shared between the Government and a local sponsor.

Preconstruction Engineering Design (PED) - This phase officially begins construction activities. As the name implies, detailed final project optimization and design are performed. For large projects it may take up to four years to complete design and prepare construction contract documents. PED costs usually range between 5-15 percent of project construction cost. It is cost-shared with a local sponsor, as part of project construction (currently 65/35 federal to local sponsor ratio for flood control projects; cost-sharing varies for other project categories).

Construction - Physical construction of large civil works projects usually exceeds one year duration and is often phased. It is cost-shared as stated above.

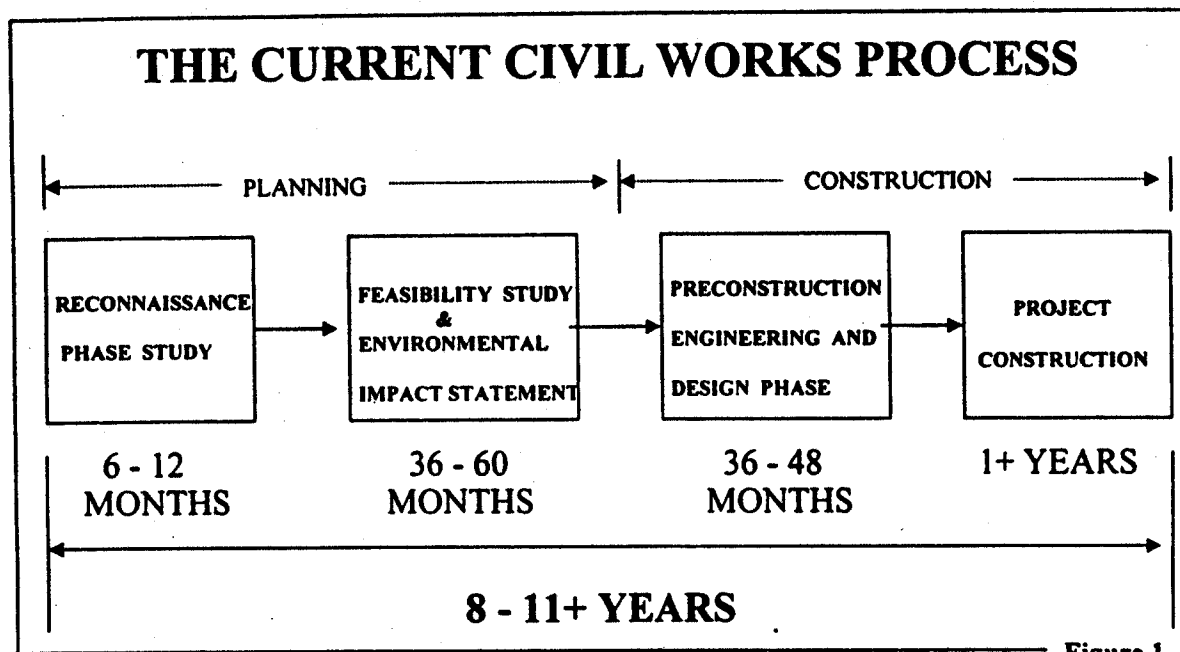


Figure 1

SOUTHEAST LOUISIANA FLOOD CONTROL; A SPECIAL CASE

In July 1992, the New Orleans District completed a reconnaissance study which addressed urban flood control for the City of New Orleans and neighboring Jefferson Parish. The study identified a \$200 million plan that would generate higher flood damage reduction benefits relative to project cost. The identified plan basically consisted of increasing existing stormwater pumping plant capacities, and, enlarging and/or concrete paving existing drainage canals. The project was approved for feasibility phase study and separate studies were initiated for both Jefferson and Orleans Parishes in 1993 and 1994, respectively. In May 1995, southeast Louisiana experienced a major flood event. Over 20 inches of rain fell in some locations over a 24 hour period. Estimated flood damages in and around New Orleans approached \$1 billion with over 30,000 structures receiving damage. As a result of this flood event local interests requested expedition of federal assistance. In response, Congress authorized (FY96 Appropriations Act) design and construction of the flood control plan identified in the reconnaissance study, foregoing feasibility phase analysis.

The New Orleans District has been tasked and challenged to expedite construction of this plan. It is being treated similarly to a 'fast track' project and all available resources are being utilized. Resources include in-house design, Corps contracted architects and engineers (A/E's), local sponsor contracted A/E's as well as local sponsor construction contracts. As mandated by law (2), all federally funded construction projects in excess of \$10 million must have a value engineering (V-E) study. In order to comply with the law the District has been further tasked to perform V-E on the project while maintaining a 'fast track' type schedule. V-E studies have been, and are currently being performed concurrent with the design of project components. With the assistance of the Corps' Value Engineering Study Team (OVEST) 11 V-E studies, covering 22 sub-projects, were completed over a one year period. Significant project savings in the range of 20 per cent of project costs are expected from current study proposals. More importantly, however, is the fact that numerous plan formulation issues, which would have normally been addressed in the feasibility study, have been evaluated as part of this V-E process. It has become apparent from this effort that the V-E process may, in some project cases, be an adequate substitute for the prolonged feasibility phase study.

THE VALUE ENGINEERING PROCESS

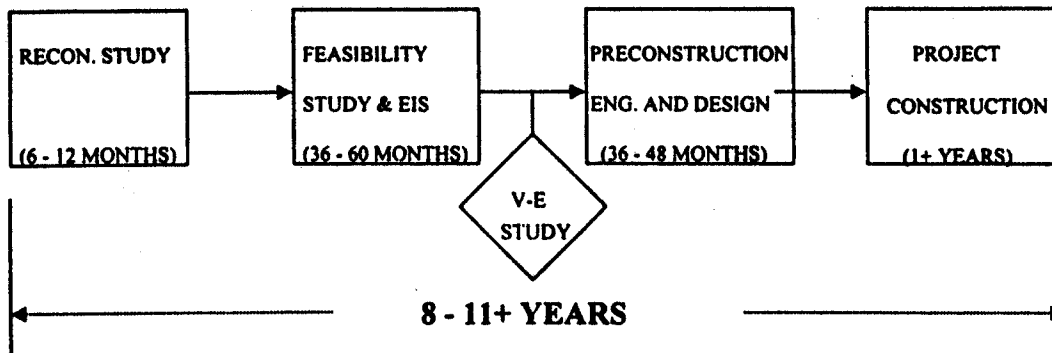
Value Engineering can be defined as "an effort to identify the best way to accomplish a project or system function through a process of applied creativity". A V-E study is conducted usually in a single week with a several week documentation and review period. A V-E study may address an entire project or a sub-component. Depending on the project's complexity, an individual V-E study's upper limit is in the range of a \$20 million project construction cost. Projects larger than this usually require more than one V-E study. An individual V-E study cost ranges between \$25 and \$50 thousand. The V-E process consists of six phases: information gathering, alternative speculation, alternative analysis, alternative development, presentation and plan implementation. It is, in fact, a fast feasibility plan formulation process.

HOW COULD THE V-E PROCESS BE USED TO EXPEDITE THE CIVIL WORKS PROCESS?

Under a normal project planning and design scenario, V-E is optimally performed immediately after completion of the feasibility phase (see Figure 2). For scheduling and resource availability reasons, V-E is usually performed later in the process. In some rare cases, V-E may be conducted a second time on a project or component if there has been significant changes. Illustrated on Figure 2 is the proposed use of V-E as a replacement for the normal feasibility study. As stated above, a V-E study identifies and analyzes project alternatives. While the short time of a V-E study does not allow a wealth of alternative detail, it can provide an adequate comprehensive analysis of the relative comparison of alternatives. A V-E study is an excellent way to quickly evaluate a broad range of project options and present their relative advantages and disadvantages in a simple qualitative analysis. Presentation of such an analysis can make the plan selection process far more understandable to the general public (and Congress) and could enhance their participation. A V-E evaluation of a plan identified from a reconnaissance study could easily be integrated with the EIS document and process. In fact, the qualitative analysis produced by a V-E study as stated above would complement the EIS 'matrix' analysis and presentation where alternative plans are rated on a variety of applicable environmental and social factors. Even though this proposed process may lack the quantity of data to precisely identify a project's NED plan solution, a comprehensive V-E study would identify a significant quantity of cost reduction and benefit enhancement measures. These results would likely produce a recommended plan that would be very close to the NED plan which maximizes return on government investment. The estimated time required to perform V-E, prepare an EIS (or EA) and go through the EIS public participation process on a major project (\$100 million) would be no more than 18 months. This could reduce the 'feasibility phase' by two to four years !

EXISTING AND PROPOSED USE OF VALUE ENGINEERING (V-E) IN THE CIVIL WORKS PROCESS

CURRENT PROCESS



PROPOSED PROCESS

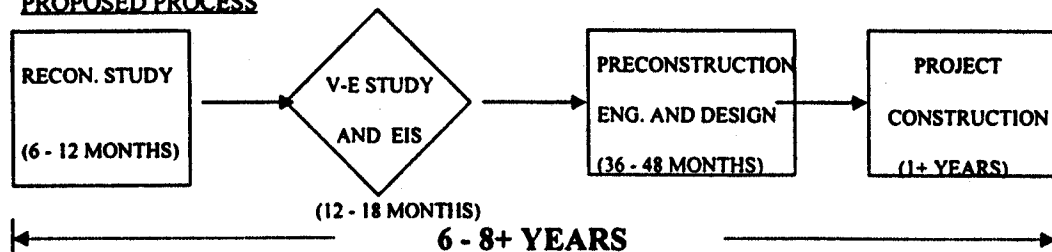


Figure 2

There is the obvious question of "How could project selection decisions be made without critical design data?". The answer may be that such data could be gathered during reconnaissance phase activities. This would require that the level of work detail be increased for some aspects of the reconnaissance study. To some extent, this would be a gamble or a hedge that the project would proceed further. Depending on the specific project, such critical design aspects could concern geotechnical, hazardous waste, hydrologic, seismic or other issues that would *only be critical* to the project. For this proposal to be effective it would therefore be required that reconnaissance activities be carefully planned and executed. Each project reconnaissance study scope would require attention to critical items specific to the project. This would require a significant amount of added flexibility to current reconnaissance study policy and guidelines. Regardless of some expanded effort in reconnaissance, the end result of the proposed V-E analysis would not offer the same level of design detail that the current feasibility study produces. This required added detail would shift back to PED activities. This should not, however, result in a significantly increased effort in PED since the design detail would be focused on a single plan.

VALUE ENGINEERING VS. FEASIBILITY STUDY

Time is money. Corps projects are no exception, particularly, those that are projected to produce significant benefits relative to costs. Consider the equivalent cost of delaying project placement by 2-3 years as could be the case given the time difference between performing a feasibility study instead of just a V-E study. This time-cost relationship is obviously affected by the anticipated benefits produced by a given project. Table 1 illustrates such equivalent value of time, relative to project benefit-to-cost (B/C) ratio, measured as a percentage of project cost. From these calculations, it becomes very clear that the extra delaying a project 2-4 years for a detailed feasibility study to be performed must produce significant value to the project to offset delayed benefits. For example, a project identified in reconnaissance evaluations to have a B/C ratio of 1.5 would lose the equivalent of *32 per cent* of equivalent project cost as a result of delaying benefits by 36 months. A project with a B/C ratio of 2.0 would lose the equivalent of almost *one-half* its cost value with a 36 month delay. For projects with very high B/C ratios it becomes ludicrous to delay its implementation if at all possible.

FEASIBILITY STUDY VALUE REQUIRED TO OFFSET DELAY							
B/C RATIO	DELAY		(MONTHS)				
			24	36		48	
=====	==	==	==	==	==	==	==
1.1			15%		23%		31%
1.2			17%		25%		34%
1.3			18%		27%		36%
1.4			20%		29%		39%
1.5			21%		32%		42%
1.6			22%		34%		45%
1.7			24%		36%		48%
1.8			25%		38%		50%
1.9			27%		40%		53%
2			28%		42%		56%
=====	==	==	==	==	==	==	==
3			42%		63%		84%
4			56%		84%		>100
5			70%		>100		>100
* Calculated at 7% interest rate and assuming typical two-year individual contract construction period and 1% of first cost total project annual operation and maintenance costs							Table 1

It is obvious that there would be some disadvantage replacing a detailed feasibility study with a single or a series of V-E studies. But one must ask: "Is the feasibility study process really worth all the time and effort?", "Does anyone ever really use most of the massive data compiled in a typical feasibility report?", "Is the calculated single value or expected value B/C ratio really accurate?", "Is there too much emphasis placed on a project's B/C ratio?". The answers to these questions indicate that a reduced and more *qualitative* effort may be appropriate for the civil works planning process. The V-E process may offer such a solution without sacrificing the benefits of a more precise selection of a project alternative. This proposed process may not be appropriate for a project with a significant number of complex technical, environmental, social or other issues. Something like a new large dam and reservoir would be such an example. For projects that may be large but are relatively simplistic, this proposed planning process appears far more favorable. In addition to the large projects evaluated in the Corps' General Investigations Program, this course of action appears to be very applicable for many smaller projects included in the Continuing Authorities Program. This program facilitates projects with a federal cost of less than \$5 million.

SUMMARY

- The Corps must address and take action to improve the execution of its civil works process.
- The special case project "Southeast Louisiana Flood Control" has necessitated the use of Value Engineering (V-E) in a unique fashion. This special utilization of V-E has shown that it may be an acceptable substitute for a normal feasibility study in some cases.
- The equivalent costs of delayed project benefits from time savings associated with using V-E in lieu of a feasibility study are measurable and can often be very significant. The value of losing such valuable time conducting a detailed feasibility study should be an important consideration.
- Using V-E as a decision making tool could provide a simple, 'less technical and more common sense' approach.
- In order to implement this proposed use of V-E, it may be necessary to expand the scope of a project's reconnaissance phase activities.
- While replacing feasibility studies with V-E may not be appropriate for projects with numerous complex issues, the Corps should consider implementing this proposal for selected projects in their General Investigations and Continuing Authorities Programs.

References:

- (1) Established by current U.S. Army Corps of Engineers Project Management and Planning Guidance
- (2) Public Law 99-662, Section 911